**A NEW WATER RESOURCES MANAGEMENT SYSTEM ORIENTED TO THE 21st CENTURY PROPOSED FOR CHANGJIANG RIVER BASIN MANAGEMENT**

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**Abstract:** Execution of river basin management in a modern concept in Changjiang River valley started in the 1920s. By 70 years’ efforts, especially through vigorous development in the 50 years since 1949, great achievements have been accomplished in every undertaking in the valley. However, with social and economic development, new conditions have emerged, which has made the current river basin management system insufficiently fit for fresh requirements. It is imperative to establish a new management system oriented to the 21st century for Changjiang valley on the basis of recalling the past and having considerations for the future. This new system shall be the guarantee for preventing flood and drought disasters in an efficient manner and promoting integrated development and sustainable use of water resources in the valley. In this paper the authors have probed into the establishment of such a system in Changjiang valley.

**Keywords:** establishment, river basin management, system, changjiang river

**1    INTRODUCTION**

In China, river basin management has existed for hundreds of years. Currently, river basin management organizations have been created for important rivers and a system has taken shape that water resources of large rivers are managed within a basin framework.  Changjiang (Yangtze) is the longest river in China. Execution of river basin management in a modern concept dated back to the 1920s. By 70 years’ efforts, especially through vigorous development since 1949, great achievements have been accomplished in every undertaking in the valley, and the strategies for river basin management have been improved substantially.  Nevertheless, with social and economic development in the valley, the current river basin management system can no longer sufficiently fit the new situations. With a view to accommodate to the needs in the new millennium, it is necessary and urgent to establish a new management system on basis of the current one. This new system shall be a guarantee for preventing flood and drought disasters in a more efficient manner and promoting the integrated and sustainable development of water resources in the Changjiang valley.

**2**    **CURRENT SITUATION OF CHANGJIANG RIVER BASIN MANAGEMENT**

Currently, water management for Changjiang River valley applies such a structure, which is a combination of basin management by the central government and regional management by local governments. Changjiang Water Resources Commission (CWRC) is the river basin management organization, dispatched by the central government to execute water administration function in the Changjiang valley. In accordance with the principle of unified management combined with departmental management, the CWRC has the responsibility to manage water resources and all river channels within the scope of the valley on basis of related laws and regulations. Its missions include: comprehensive harnessing of water resources, administration and management of backbone water projects, long-term river basin planning, water administration, water development coordination, supervision and service-providing and the integrated development, utilization and protection of water resources.  Local governments within the valley can carry out regional water management schemes tailored to the actual conditions under its administrative jurisdictions according to related regulations. It is an important component of river basin management and the materialization of unified management combined with regional management. At present, the main tasks assumed by the CWRC in harnessing, development and management of water resources in the Changjiang valley and related problems are as follows.

**2.1    The CWRC has Been working for the establishment of a sound water management system centered on water administration in the valley**

Water administration department is the core department for river basin management in the valley. The main tasks in this field are the following: publicizing related laws, regulations and policies and supervising their execution; participating in the formulation of and amendment to related laws, regulations and policies; resolving inter-provincial water affair disputes; carrying out water resources management and river channel management; executing the law for water administration and other related activities. The primary problems involved in this field are as follows: Institutional and policy weaknesses concerning the legal position and administration functions of the river basin management authority, which needs to be strengthened; Shortage of efficient means for this authority to coordinate benefits between different regions and different sectors.

**2.2    Flood prevention and disaster reduction have been the focus in striving for the comprehensive harnessing of the river**

Flood disaster is the most severe natural hazard in Changjiang valley, always with huge flooding losses. Flood prevention and disaster reduction have been the priority task for the CWRC. Through continual construction of flood control projects, flood control standards on Changjiang River have been raised significantly. Since the year of 1954, in which an extraordinary heavy basin-wide flood occurred, the main dykes have withstood all the heavy floods happened on the River ever since, the 1998 floods in particular, which has demonstrated the great achievements in flood control engineering constructions. Safety for hundreds of millions of people’ properties and lives has been ensured and the continual and stable growth of national economy guaranteed. Nevertheless, due to the fact that ground elevations in the plain areas on the middle and lower Changjiang are generally lower than flood stages of the River and that flood control standards are in general on the lower side, flood control situations on the Changjiang have always been severe.

**2.3    Water and soil conservation has been implemented with force in the changjiang valley**

Attention has also been paid to both ecological system protection and water and soil conservation. Up to now, more than 100,000 sq. km areas of water and soil loss regions have been brought under control. In these conservation areas, water and soil loss has basically halted and environment quality improved. However, water and soil loss in the valley has not been completely brought to an end. It is estimated that the amount of area existing water and soil loss is about 560,000 sq. km in the valley. The areas are still increasing due to human activities such as deforestation. Sediment load discharged into the sea reaches 500 million tons each year.

**2.4    Great importance has been attached to the fundamental undertakings in basin development by the CWRC, which has helped provide the basis and guarantee for river basin management in a scientific manner**

Hydrologic and survey data collection and processing have provided basic data for planning, scientific researches, design, flood fighting and water administration and basis for decision making. Currently, there are more than 6400 hydrologic and meteorological stations in the valley with many survey and experimental units scattered all over the valley.  However, great difficulties have always been encountered for these units to carry out their works due to institutional and market factors. These difficulties include fund shortage, too heavy burdens of various kinds, difficulty in translating scientific and technological advances into production forces and competition without order.  All this has severely constrained the smooth implementation of fundamental programs in the valley.

**2.5    River basin planning has been an important task of the CWRC, which has provided basis for basin development and disaster prevention**

During the mid-1950s, the CWRC carried out overall river basin planning in the light of requirements for economic development at the time. In 1959 the CWRC formulated the *Report on Main Points of Changjiang Valley Comprehensive Planning*, which has been the guidance for the development, harnessing and management of the River. In the years that follow, the CWRC has completed designs for Three Gorges Project, Danjiangkou Project and so on, planning for river reaches of the main stem and the primary tributaries and planning for South to North Water Transfer, flood control on the middle and lower Changjiang River and river training and so forth. The planning principles are unified planning, overall development, appropriated division of works and implementation by stages.  In the 1980s, the CWRC made amendments and supplement to the above mentioned Report on Main Points and worked out the *Simplified Report on Changjiang Valley Comprehensive Planning*. This report has been approved by the State Council in December 1990 and made the basis for the development, utilization and protection of water resources and flood prevention in the valley.  However, there is a shortage of definite legislation for supervising the implementation of river planning so as to ensure the execution of the planning. It happened now and then events that violated the planning principles. There exist weaknesses in functions for the river basin management authority to execute macroscopical management and supervision.

**2.6    The execution of water management for protection of the precious resources has been an important responsibility for the river basin management authority**

Up to now, the CWRC has received 75 pieces of water withdraw register applications and granted 45 pieces of water withdraw licenses, the annual approved withdraw amount totaling 374.1 billion m3. Through implementation of water quality monitoring and protection measures, the discharging of pollutants in the valley is being brought under control. Great efforts have been made to realize unified management of water quality and water quantity so as to guarantee the sustainable development of water resources in the valley. However, due to the fact that water management operations have not been completely put into place and that water quality management system has not been tidied up yet, water management in the valley has been severely hampered.

**2.7    CWRC has further provided services to and participated in social and economic constructions in the valley**

Upon the firm footing of carrying out survey and exploration, design and scientific researches for water resources and hydropower development, the CWRC has actively involved it in other fields, such as construction, transportation, information, commerce, trade and so on. It has made unique contributions to water resources and hydropower development, especially the construction of large-scale backbone projects in the valley, contributing a great deal to social and economic growth. However, the current market of survey and exploration, design and scientific researches is not adequately mature yet, and related regulations have not been made sound and complete, which has influenced the execution of these activities. In addition, for lack of fund and policy support from the government, the river basin management authority is hard to organize construction of backbone projects on the main stem and its primary tributaries and to carry out rolling development planning. It is prescribed in a State Council approved responsibility-division scheme that river basin management authorities shall assume the responsibility to organize the construction and to manage the backbone water projects or key inter-provincial projects. Actually this provision is just idle theorizing, because the river basin management authorities have no means to develop their mainstay businesses, say no more of rolling developments.

**3**    **EXPERIENCES FROM OVERSEAS RIVER BASIN MANAGEMENT PRACTICES**

The concept of unified water management on a basin basis has been accepted widely.  Currently, there are success cases in implementing river basin management in the world.  Included are the Tennessee Valley Authority (TVA) pattern in the U.S., the Rhone River Corporation management pattern in France and the Thames Water Affairs Authority pattern in U.K. All these management patterns have one point in common. That is, they have established sound management systems tailored to its actual conditions and achieved success in executing river basin management.  The experience accumulated is of reference value to us.

**3.1    The TVA pattern**

The TVA was created by the U.S. Congress with the advice from the president for the purpose of developing and harnessing the Tennessee valley. It is an independent federal corporation with strong administration power and the flexibility and creativity of a private company type. The TVA’s aim, objectives, operation scope, rights and responsibilities are definitely specified by legislation.

The TVA has multiple objectives. With a view to reduce contradictions caused by the duplication of functions with other executive agencies, the TVA was granted relatively high independence of self-rule. The TVA is administrated by a board of three officials who are appointed by the president, subject to the approval by the U.S. Senate. All the rights are in the hand of the Board, including personnel management, finance and price setting. The officials selected to the Board were generally experts of related fields. All the important decisions are collectively made by the Board.

In order to facilitate growth of the TVA, the federal government granted to the TVA many privileges. A few large-scale enterprises and power stations were transferred to the hand of the TVA. Its properties and incomes were exempted from taxation. Government guarantee was granted to the TVA to facilitate the issuing of business bonds to support construction of key projects and so on. Under unified management of the TVA, striking success in flood control, transportation, power-generation, agriculture, forestry, fishery and tourism has been achieved through more than 60 years comprehensive development in the valley. The success has been recognized world widely and the TVA was imitated in many countries with the creation of similar river basin management agencies. They have many in common. ① The establishment of such agencies is aimed at improving economic conditions of river basins.  And the agencies are granted a wide range of powers for promoting social and economic development in the basins. ② These agencies are independent executive departments of the governments and are responsible directly to the central governments. ③ The agencies are of high self-rule independence, which is specified through legislation. ④ Special funds are appropriated for start-up development and follow-up development is supported.  Corresponding policy supports are provided.

**3.2    The Rhone river corporation management pattern**

With a view to coordinate relations and benefits of different districts and different sectors during development and harnessing of the Rhone River, the legislative body of France enacted a law in 1921 creating the Rhone River Corporation (RRC). In the mean time, chartered concession was granted to the RRC to develop and manage the Rhone River.

The RRC is a joint-stock public utility company controlled by French government.  Its main missions include hydropower generation, navigation and irrigation in the basin and development of riparian land. When executing its functions, the RRC is the owner, the contractor and the manager.  At present, the RRC has 320 stockholders, including local governments related directly with development of the basin, public and semi-public organizations, such as the State Power Corporation and the National Railway Corporation.

A board of directors was set up in the RRC, chairpersons of it are cabinet members, generally politicians. The board is consisted of 30 persons, seven from related executive departments of the government, five stockholder representatives, five staff representatives, five experts and 8 beneficiary representatives. The board calls a meeting in every month, discussing and making decisions on important issues and the general-manager’s report to the board. Under the board is the general-manager, who is in charge of daily affairs of the company.

During the time period of more than half a century, cascade development of the 500-km river channels in the French territory has been completed, as planned in river basin planning.  The Rhone River has been one of the most fully developed rivers in the world. The basic experience is as follows. The comprehensive development is based on reasonable planning, favorable policies and modern management rules. Hydropower exploitation is the mainstay business, which is made the base for developing and harnessing the whole river and realizing follow-up development. Full considerations have been given to the comprehensive development and conservation of water and soil resources in development planning. Flood control, hydropower generation, navigation, water supply and environment protection are equally considered. Policy support is available from the Government. The RRC was granted the chartered concession to exploit and manage the Rhone River and the riparian land for 100 years. As a nonprofit public utility agency, the RRC’s incomes of various kinds are exempted from taxation. The company does not need to distribute dividends to large amount of local shares. Resources fees of several types are collected by the RRC to make up fund deficit.  The company has the right to determine sale prices for its power supply by considering the operation and maintenance cost, payment of loan and interests and ensuring reasonable profits so as to guarantee good performance of the company. Scientific management rules and modern operation tools are made use of. All this has made it possible for a limited number of employees to manage a huge system in an efficient manner, including water administration, project construction, operation and maintenance and scientific researches and so on.

**3.3    Thames water affair authority (TWAA) management pattern**

The TWAA is one of the 10 water affair authorities established in the U.K. according to the Water Act of 1973. Its main missions include formulation of long-range water management strategy and plans; development and construction of new water sources; providing with clean and adequate water to residents under its jurisdiction; sewage processing; restoring and safeguarding the cleanness and sanitation of the river and other water bodies; maintaining, improving and expanding freshwater fishery; full supervision of land drainage and flood control under its jurisdiction; providing protection for recreation water bodies and related land; investigation of integrated water management situations under its jurisdiction and working out medium- and long-range water supply plans.

The executive body of the TWAA is the board of directors. The chairperson of it is appointed by the Environment Secretary (ES). Members compose of two parts. One is the persons appointed by the ES, and the Agriculture, Fishery and Food Secretaries. The other part is local representatives. The number of representatives appointed by the government shall not outnumber that of the local ones. The board is responsible for working out long-range strategies and policies and employing the general-manager for the daily works.

The water affair authority (WAA) is a non-government agency.  Actually it is a highly independent public utility organization that assumes sole responsibility for its profits or losses (flood control and drainage are funded by appropriations from governments of all levels).  The WAA has the right to determine charging standards for its services and collecting fees.  The basic principle is to ensure a balance between its incomes and expenditures plus prescribed profit rates. Fees collected include water fees, sewage fees, drainage fees, environment protection fees and water resources fees and so on.

**4**    **ESTABLISHMENT OF A NEW WATER RESOURCES MANAGEMENT SYSTEM ORIENTED TO THE 21ST CENTURY**

To sum up, the establishment of a new water management system oriented to the 21st century is of extremely importance to realize sustainable development of water resources and promoting speedy and stable growth of society and economy in the valley. This new management system shall have such basic characteristics as follow.  (1) The river basin management agency shall be more powerful. (2) Management contents shall be extended to include all the fields of water resources, which shall be wider than the existing items. (3) The responsibilities and rights of river basin management and regional management shall be more definitely divided. (4) Regional management shall be subordinated to river basin management and sector management subject to integrated management. The river basin management authority shall be the main part assuming the responsibility of river basin management and development. Backbone water-resources development programs in the valley shall be controlled from the very beginning to the end by this authority on behalf of the government, so as to make the comprehensive strength of this authority continually grow. Therefore, the newly established river basin management structure for Changjiang valley shall have the following function systems. ① a more perfect water administration system; ② solid fundamental program system; ③ high-level scientific research and consultation-providing system; ④ multi-level finance support system; ⑤ perfect project approval, construction and management and quality monitoring system; and ⑥ flood disaster prediction, forecasting, monitoring, assessment and emergency handling system.

**4.1    Establishment of a powerful river basin management authority**

To strengthen river basin management, a powerful agency need to be created, which can be called, for example, the Changjiang Valley Water Commission (CVWC) or Changjiang Valley Sustainable Development Commission. This commission can be headed by the leader of the State Council and compose of chiefs from related ministries and departments, the provinces, autonomous regions and municipal cities in the valley. This commission will assume full responsibility for development and utilization of water resources, flood prevention and disaster reduction and environment protection in the valley. The establishment of such an agency shall be an important organizational guarantee for integrated water resources management in the valley. At present, the Changjiang Flood Control General Headquarters and the Upstream Changjiang Water and Soil Conservation Commission have already been established. It is planned to create the Changjiang Valley Water Resources Protection Commission. In the light of this, the proposed comprehensive CVWC can assimilate all the commissions mentioned above, as its professional ones after making certain adjustment to their member compositions. The proposed CVWC can apply such organization pattern as follows.

The head of the Committee can be concurrently held by the Premier or a vice-premier.  Committee members can compose of chiefs of the State Development and Planning Commission, Ministry of Water Resource (MWR) and related ministries and departments and the chiefs of provinces (autonomous regions and municipal cities) in the valley and the Commissioner of the CWRC, who can also concurrently hold the post of Secretary-General.

A so-called Office of Changjiang Valley Water Commission can be set up as its standing committee for managing daily affairs. This Office can be set based on the existing CWRC, which shall be retained to execute the tasks assigned by the MWR.

**4.2    Adequate empowerment of the river basin management authority through legislation**

With construction and perfection of the socialist legal system in China, it has been made possible for this authority to manage the river basin on basis of law.  The law-based management of river basin presupposes the establishment of sound laws and regulations.  Relations of various kinds in river basin management shall be specified by legislation, and the management authority shall be adequately empowered for it to carry out its responsibilities.  A counterpart law-execution system for water administration shall also be established, to create a good water resources management environment governed by laws and regulations.

**4.2.1  Establishment of a more perfect legal system for river basin management**

The Water Act, the basic law for water resources management, shall be taken as the basis for such a legal system.  Meanwhile, the actual conditions in the valley shall be given full consideration. Therefore, when making amendments to the Water Act, it is proposed to highlight such points as follow. It shall be specified that the river basin management authority is the main body for river basin management. Responsibilities and rights of river basin management and regional management shall be definitely described.  The river basin management structure shall be tidied up. Functions of this authority shall be further consolidated and strengthened. Stronger policy support shall be given to this authority for its continual growth. In addition, the enactment of River Basin Management Act shall be speeded up and the making of Changjiang Act shall be listed on the lawmaking plan. The proposed Changjiang Act will be the basic law for integrated water resources management in the valley. The basic principle for river basin management shall be stressed.  And such issues shall be clearly specified as long-range river basin planning, flood control, water administration and water resources development, water and soil conservation, water resources protection, hydrometry, river channel management, dyke construction, use of shoals, construction and management of flood diversion and detention basins, administration and management of backbone water projects in the valley and so on.  In the meantime, counterpart local and basin wide laws shall also be formulated, with a view to form a unified and complete legal system composing of national, basin wide and local laws for the proposed Changjiang Valley Water Commission to carry out its duties.  An independent and adequately empowered law-execution body shall be created to execute the law for water administration.

**4.2.2  Empowerment of the river basin management authority**

The proposed CVWC is the highest level decision-making and administration body for water management in the valley. All the important issues, except for those under the State macroscopical control, shall be decided by this commission on periodic or called at need meetings. The CVWC Office shall assume the responsibility for implementation and supervision of these decisions.

The proposed CVWC shall have the following primary functions: decision-making on key issues such as flood control, water and soil conservation and water pollution prevention; decision-making for water administration and for comprehensive development planning; proposal approval, examination or prequalification of key water projects; decision-making for comprehensive development investment plan, budgetary and final accounting; examination and approval of water allocation schemes; quality monitoring, progress supervision and appraisal and check of comprehensive development programs; coordination and resolving inter-province water affair disputes; and administration and management of backbone projects on the main stem of Changjiang and its primary tributaries on behalf of the State investor.

**5**    **CONCLUSIONS**

Water resources management practices at home and abroad have proven that integrated management on a basin basis is an efficient means for water management. As a river basin management agency accredited by the State, the CWRC has made substantial contributions to promoting water resources integrated management in the valley. With social and economic development, the needs for a new water resources management system oriented to the 21st century have become apparent. The establishment of such a new system will guarantee the sustainable development of water resources in the valley. This new system shall have the following basic components: a powerful river basin management authority; more perfect and complete function system and legal system for river basin management; an independent adequately empowered law-execution body for water administration; sufficient power granted through legislation to this authority to fulfil its responsibilities; and policy support provided for the growth of the authority.

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